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# Presence of *Leucocoprinus cretaceus* and *L. fragilissimus* in Argentina

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Abstract — *Leucocoprinus cretaceus* and *L. fragilissimus* are recorded for the first time in Argentina. These species are described and illustrated, and a key to the Argentinean species of this genus is presented.

Key words — *Agaricomycetes, Agaricales, Agaricaceae*, *Leucocoprineae*, taxonomy

## Introduction

*Leucocoprinus* Pat. was considered by Singer (1986) to belong to the tribe *Leucocoprineae* Singer in the family *Agaricaceae* Chevall. The genus is characterized by a pluteoid habit, convex to umbonate pileus with floccose pulverulent squamules, a striate-sulcate margin, a very thin context, free lamellae, and the absence of colour changes with ammonia vapour, a central stipe with bulbous-clavate base and annulus, and a white to pale pink spore-print. The basidiospores are smooth, hyaline, thick-walled, with or without an evident germ pore, dextrinoid, metachromatic in cresyl blue, basidia are 4-sterigmate, pleurocystidia are either absent or not numerous, and cheilocystidia are usually abundant. The pileipellis is very variable, formed by a mixture of different types of cells and hyphae, and generally is a disrupted epicutis mixed with sphaerocysts or chains of branched/unbranched inflated hyphae that sometimes form erect, loose fascicles comprising the squamules. The hymenophoral trama is regular and trabecular and clamp connections are absent. *Leucocoprinus* species are solitary to gregarious, terrestrial, and saprotrophic (Singer 1986, Vellinga 2001, Gimenes 2007, Rother & Borges da Silveira 2009). The most similar genus, *Leucoagaricus* Locq. ex Singer, differs

mainly by lacking a long striate-sulcate pileal margin, having a thinner context, and lacking pseudoparaphyses (Pegler 1983, Singer 1986, Vellinga 2001).

*Leucocoprinus* has a pantropical distribution and is also found growing in greenhouses of temperate regions (as introduced species) (Vellinga 2004). The genus comprises approximately 40 species worldwide (Kirk et al. 2008). In Argentina the specific diversity of this genus is poorly known. Only six species and two infraspecific varieties have been recorded so far (Raithelhuber 1974, 1987a–c, 1988, 1991, 2004; Singer & Digilio 1952, Spegazzini 1898, 1926; Wright & Albertó 2002).

This paper resulted from research into the diversity of *Agaricales* from the rainforests in northern Argentina. The Atlantic Forest, which stretches along the Atlantic coast of Brazil with its southern border reaching eastern Paraguay and northeastern Argentina, is one of the most threatened tropical-subtropical rainforests in the world (Placi & Di Bitetti 2006) and regarded as one of the 25 biodiversity hotspots for conservation (Myers et al. 2000). The aim of this paper is to report the results of the study of recent collections of *Leucocoprinus* from this habitat.

## Materials & methods

The authors recently collected the specimens in protected areas from northern Argentina. The specimens were macroscopically described according to Largent (1986) and Lodge et al. (2004). Color names are in accordance with Kornerup & Wanscher (1978). Microscopic features are described from material mounted in 5% KOH and phloxine (1%). Meltzer's reagent, cresyl blue, and cotton blue were used to determine whether the spores were dextrinoid, metachromatic, and cyanophilic, respectively. Dimensions were recorded from 20 basidiospores per collection. Standard deviation, quotient of length/width (Q), and average Q-value (Qm) were calculated for each species from all spores measured (n). Herbarium abbreviations follow Index Herbariorum (Thiers 2011). Complete synonymies are not presented; for a complete list see Vellinga (2010). The collections are deposited in CTES Mycological Herbarium.

## Taxonomy

***Leucocoprinus cretaceus*** (Bull.) Locq., Bull. Mens. Soc. Linn. 14: 93 (1945). Figs 1–5
≡ *Agaricus cretaceus* Bull., Herb. Fr. 8: tab. 374 (1788).

Pileus 27–75 mm diam., at first ovoid then convex to broadly conical, umbonate in maturity, white (1.A1), covered by easily removed, granular floccose, white squamules, conical to pyramidal on the umbo; margin entire, sulcate. Lamellae white, crowded, free, membranous, 2–4 mm wide, with lamellulae; margin entire. Stipe 50–90 × 3–7 mm, central, cylindrical, becoming inflated fusoid towards the base, 15–30 × 8–15 mm, white, glabrescent, fistulose, with a covering of floccose squamules from the base to the annulus. Annulus present, attached to the upper part of the stipe, simple, membranous, white,

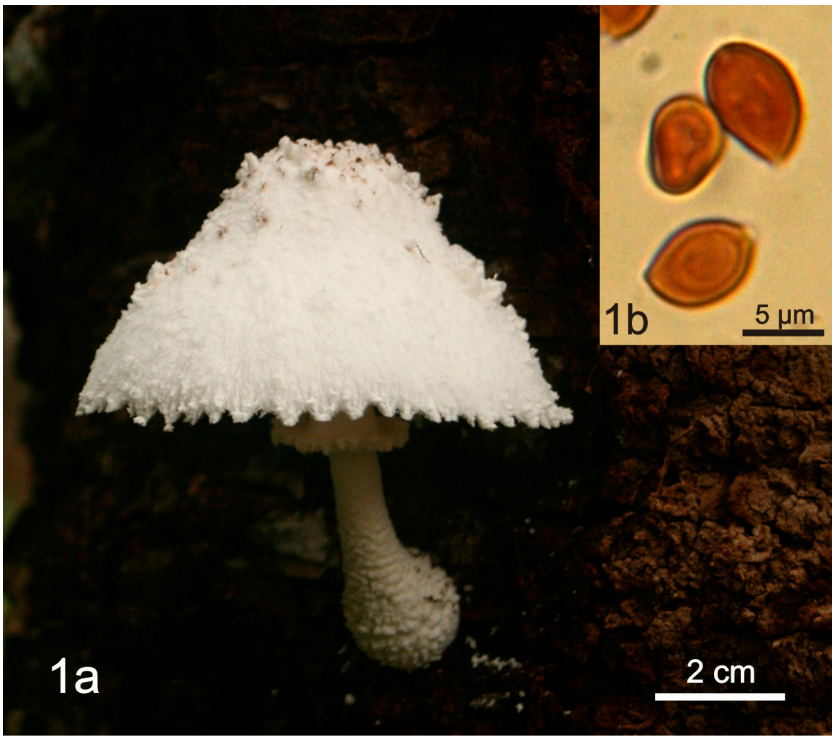
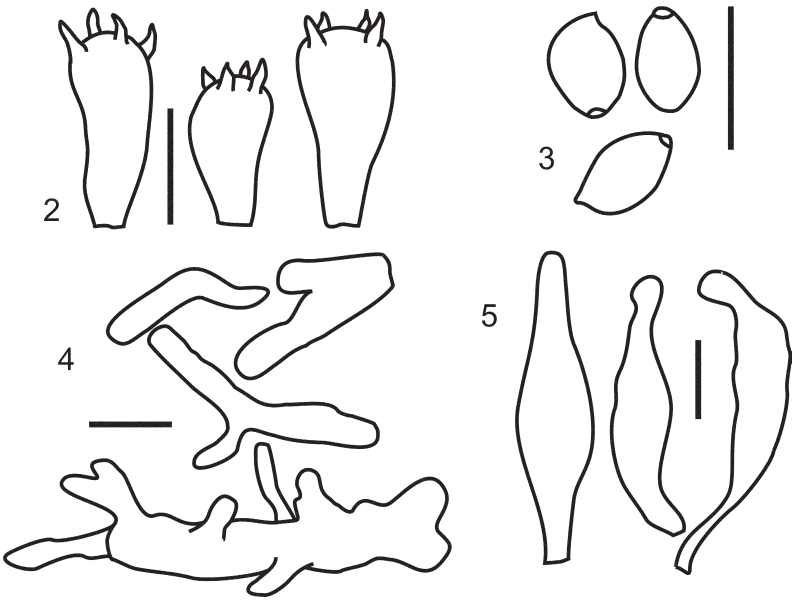



Fig. 1: *Leucocoprinus cretaceus* (Niveiro & Michlig 1614 CTES)
a: general aspect; b: spores in Meltzer's reagent.

evanescent. Context white, thin. Spore print white.

Basidiospores 6.8–10 × 5–6.6 µm (8.5 ± 0.8 × 5.7 ± 0.4 µm); Q = 1.2–1.7 µm; Qm = 1.5, n = 60, ellipsoid, hyaline, smooth, thick-walled, walls 0.6–0.7 µm, with an obvious germ pore, dextrinoid, metachromatic, cyanophilic. Basidia 18–30 × 7–11 µm, claviform, with 4 sterigmata. Pseudoparaphyses 11–18 × 6–10 µm, claviform. Pleurocystidia absent. Cheilocystidia 38.3–46.6 × 8–16(–20) µm, narrowly clavate, lageniform to ventricose, thin-walled, hyaline. Hymenophoral trama regular, hyphae 3.6–8 µm, with smooth, thin walls; inamyloid. Pileipellis made up of hyaline hyphae with smooth walls and cylindric terminal elements with excrescences, branched in different shapes (H, T and Y), 24–45 × 7.5–15 µm. Stipitipellis a cutis of narrowly cylindrical, 2–7 µm broad hyphae. Clamp connections absent.

Habitat (of Argentinean collections) — Solitary or gregarious. On bark of living gymnosperms (*Araucaria angustifolia*) and unidentified dicotyledonous trees in subtropical forest.




Figs 2–5: *Leucocoprinus cretaceus* (Niveiro & Michlig 1614 CTES)
2: basidia; 3: spores; 4: pileipellis; 5: cheilocystidia. Scale bar = 10 µm.

Material examined — **ARGENTINA, Corrientes**: Dpto. Mburucuyá, Mburucuyá National Park, "Che Roga" trail, 6/IV/2007, leg. Niveiro & Michlig 441 (CTES); Santa Teresa Ranch, 7/IV/2007, leg. Niveiro & Michlig 480 (CTES). **Misiones**: Dpto. Gral. Belgrano, San Antonio Natural Reserve, on *Araucaria angustifolia*, 26º02′14.2″S 55º47′24.8″W, 526 m, 29/V/2009, leg. Niveiro & Michlig 1614 (CTES).

Distribution — *Leucoagaricus cretaceus* is distributed in tropical regions and adjacent temperate regions in North America and Europe (Vellinga 2001, Birkebak 2010). It has been recorded from Africa, Asia, Europe, North America, and South America (Brazil: Gimenes 2007, Meijer 2006, Rother & Borges da Silveira 2009, Sobestiansky 2005, Wartchow et al. 2008). This is the first record of *L. cretaceus* in Argentina (Misiones and Corrientes Provinces).

Comments — *Leucocoprinus cretaceus* is easily recognized by its fleshy white basidiomata covered by floccose squamules that are easily removed when touched and by a fusoid stipe inflated toward the base. This species is related to *L. squamulosus* (Mont.) Pegler from Guyana and Lesser Antilles with similar basidiospores but which lacks an annulus and an inflated stipe base (Pegler 1983, Dennis 1952, Wartchow et al. 2008).

Dennis (1952, 1970) and Pegler (1977, 1983, 1986) identified tropical species with a white basidioma and pileus covered by concolorous floccose

squamules as *Leucocoprinus cepistipes* (Sowerby) Pat. However, Candusso & Lanzoni (1990) and Vellinga (2001) considered *L. cepistipes* a separate species based on the ochraceus to pale brown squamules covering the pileus surface (Candusso & Lanzoni 1990, Wartchow et al. 2008, Gimenes 2007). Vellinga (2001), Gimenes (2007), and Rother & Borges da Silveira (2009) explain these conflicting species concepts.

***Leucocoprinus fragilissimus*** (Ravenel ex Berk. & M.A. Curtis) Pat., Essai Tax. Hyménomyc.: 171 (1900). Figs 6–8

≡ *Hiatula fragilissima* Ravenel ex Berk. & M.A. Curtis, Ann. Mag. Nat. Hist., Ser. 2, 12: 422 (1853).

Pileus 20–44 mm diam., conic-campanulate, becoming plane with a small umbo, even depressed, sulcate-striate to the umbo, white to slightly yellowish (1.A1–1.A3) when young, becoming whitish and almost translucent except for a central disk in maturity, umbo pale yellowish-brown (1.A4) with small yellow squamules, dry. Lamellae white, thin, subdistant, free, with lamellulae; margin entire. Stipe 60–100 × 1–2 mm, equal, fragile, central, light yellow (1.A5), with scattered small yellowish squamules, fistulose. Annulus present, white, small, membranous, movable, evanescent, attached to the upper to middle part of the stipe. Context white, very thin, almost absent, except at the disk, membranous, subdeliquescent. Spore print off-white.

Basidiospores 9–12.7 × 6.5–10 µm (11.1 ± 0.8 × 8.1 ± 0.6 µm); Q = 1.1–1.6; Qm = 1.4, n = 54, broadly ellipsoid to subglobose, smooth, hyaline, thick-walled, with an obvious germ pore with a hyaline dome, dextrinoid, metachromatic, cyanophilic. Hymenial elements not observed. Pleurocystidia and Cheilocystidia unobserved. Pileipellis an epithelium with hyaline, globose, more or less isodiametric elements, 17.2–25.3 µm in diameter, thin-walled, mixed with hyaline, thin, more or less cylindrical hyphae. Stipitipellis a cutis of narrowly cylindrical, 5–12 µm broad hyphae. Clamp connections absent.

Habitat (of Argentinean collections) — Solitary or gregarious in small groups. On decomposing dicotyledonous wood and in soil among litter in subtropical pastures and forests.

Material examined — **ARGENTINA**, **Corrientes**: Dpto. Mburucuyá, Mburucuyá National Park, 7/IV/2007, leg. Niveiro & Michlig 448 (CTES); 8/IV/2007, Santa María Ranch, leg. Niveiro & Michlig 496 (CTES). **Misiones**: Dpto. Gral. Belgrano, San António Natural Reserve, 26°01′41.4″S 53°47′20.8″W, 322 m, 28/V/2009, leg. Niveiro & Michlig 1477 (CTES); Dpto. San Pedro, Moconá Provincial Park, 27°09′25.0″S 53°54′07.9″W, 289 m, 25/V/2009, leg. Niveiro & Michlig 1356 (CTES).

Distribution — *Leucocoprinus fragilissimus* has a pantropical distribution (Pegler 1983). It has been recorded from Africa, Asia, Europe, North America, and South America (Ecuador: Reid et al. 1981; Brazil: Albuquerque et al. 2006, Capelari & Maziero 1988, Gimenes 2007, Pegler 1997, Rother & Borges da

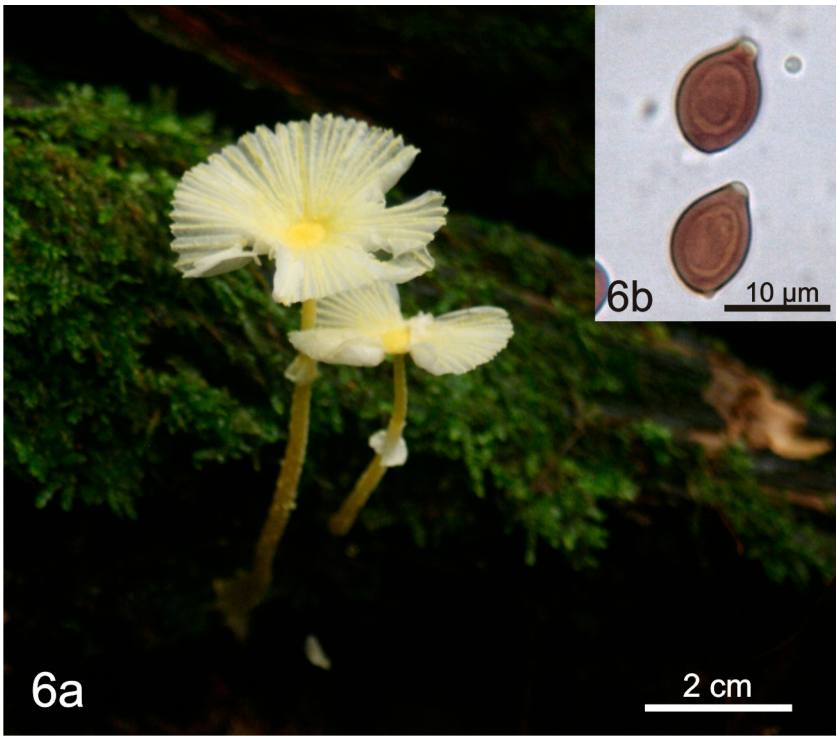
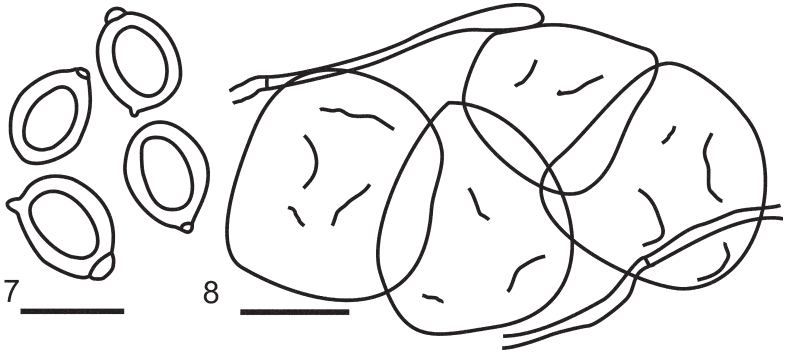



Fig. 6: *Leucocoprinus fragilissimus* (Niveiro & Michlig 1356 CTES)
a: general aspect; b: spores in Meltzer's reagent.

Silveira 2009, Wartchow et al. 2008). This is the first record of this species in Argentina (Misiones and Corrientes Provinces).

Comments — *Leucocoprinus fragilissimus* is widely distributed in the tropics and subtropics (Halling & Mueller 2005). It is characterized by subdeliquescent basidiomata and a membranous, yellowish-white pileus with small yellow squamules (Pegler 1983, Rother & Borges da Silveira 2009). Although the hymenial elements were not observed in our collections due to the subdeliquescent pileus, the basidiospore shape and size and pileipellis structure completely agree with those of this species.

According to Pegler (1983) and Smith & Weber (1982), *L. fragilissimus* is probably a common pantropical species but rarely collected owing to the extremely delicate basidiomata, which make field collection difficult. The presence of cheilocystidia in this species is rarely mentioned. According to Smith & Weber (1982), the cheilocystidia are 13–25(–36) × 9–15(–20) µm in size.




Figs 7–8: *Leucocoprinus fragilissimus* (Niveiro & Michlig 1356 CTES)
7: spores; 8: pileipellis. Scale bar = 10 µm.

*Leucocoprinus tenellus* Pegler [nom. illegit., non (Boud.) Locq.] from the Lesser Antilles and *L. thoenii* Heinem. from Zaire are also species with thin fragile basidiomata. Their habit and spore shape also resemble *L. fragilissimus*, but *L. tenellus* and *L. thoenii* differ in the absence of any yellow pigments (Pegler 1983). *Leucocoprinus brunneoluteus* Capelari & Gimenes from Brazil also has fragile basidiomata but differs from *L. fragilissimus* in its more yellowish coloration and the presence of brown umbo and squamules (Capelari & Gimenes 2004, Rother & Borges da Silveira 2009).

**Key to species of *Leucocoprinus* in Argentina**

1a. Basidiomata yellow or yellowish-white . . . . . .2
1b. Basidiomata white, brownish to pinkish-orange (i.e. non yellowish) . . . . . .4
2a. Pileus extremely thin and subdeliquescent, white with bright yellow small adpressed squamules . . . . . *L. fragilissimus*
2b. Pileus fleshy, pale yellow to sulphur yellow, covered by loose, scattered, floccose squamules . . . . . .3
3a. Pileipellis made up of elongated elements; spores 7–10 × 5–7 µm, with an obvious germ pore . . . . . *L. birnbaumii*
3b. Pileipellis made up of globose elements; spores 5–7.5 × 3–5 µm, without an obvious germ pore . . . . . *L. straminellus*
4a. Pileus pinkish-orange; stipe with reddish, greenish, or bluish tinges; spores 3.5–4.5 µm broad. . . . . *L. fibrillosus*
4b. Pileus white to yellowish-brown, pale brown or greyish; stipe whitish, without reddish, greenish or bluish tinges; spores 5–8 µm in broad. . . . . .5
5a. Pileus 15–25 mm in diam., hemispheric to convex, pale brown with a darker center. . . . . *L. acer*
5b. Pileus 20–75 mm diam., conic-convex, campanulate, umbonate in maturity, white, greyish to yellowish-brown . . . . . .6

6a. Pileus covered by ochraceus squamules, darker in the center; stipe greyish white to yellowish, smooth or covered by scattered squamules ..... *L. cepistipes*

6b. Pileus covered by white, floccose squamules; stipe covered by white floccose squamules from the annulus to the base ..... *L. cretaceus*

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